the future a very considerable reduction in the species of this genus will also be necessary. *Madrepora* itself is a genus with a very wide geographical distribution in shallow tropical waters, like *Millepora*. Its coralla are also subject to extraordinary variability in their form of growth, and the species have been founded on skeletal characters only. All the species, or many of them, may be good, but the classification of the genus must be considered to be unsatisfactory until our knowledge of the anatomy of the polyps of the different varieties has been considerably extended.

2. On the Perforate Corals collected by the Author in the South Pacific. By J. Stanley Gardiner, M.A., Gonville and Caius College, Cambridge.

[Received January 31, 1898.]

(Plates XXIII. & XXIV.)

Of the Perforate Corals obtained by me in the South Pacific I have been able to refer specimens to fifty-one species; of these fifteen seem to me to be new. Three of these have already been described by Mr. Bernard in the British Museum Catalogue, and the characters of twelve are now given. I have so far as possible compared my specimens with those in the British Museum, and, although I have referred back to the original descriptions in nearly all cases, I give, for those genera of which the Museum has published a catalogue, simply one reference, namely to that catalogue, by placing the number of the species in it after the name in parentheses.

I am much indebted to Mr. Bernard for his assistance in comparing the *Astræopora* and *Turbinaria*, and for writing the description of *Montipora columnaris*. Prof. Jeffrey Bell, too, has kindly placed at my disposal every facility which the British Museum affords.

I. Genus Madrepora.

Madrepora Linnæus, Syst. Nat. ed. x. p. 793; Duncan, Rev. Madrep. p. 183.

The specimens of this genus in the collection are generally rather small, most of them having been obtained by diving or dredging. I have been able to refer specimens to 25 species, and in addition I have described 3 which I consider new. From Funafuti there are also fragments of two species from 30 fathoms, two from 20 f., and five from 6–8 f.: of these, four species seem to be new, but they are too small to attempt to describe. There are, too, a number of young colonies unidentified.

Generally, on the reefs of Rotuma and Funafuti I found that, although certain species are locally very common, there is little

[1] Communicated by W. Bateson, F.R.S., F.Z.S.

variety; on shoals a few fathoms submerged, the latter is often very considerable, one shoal off Oinafa, Rotuma, with 2–4 fathoms of water, giving seven species, while I have been able to identify only four from the reefs and boat-channel of that island. From Funafuti, three species are recorded from 35 fathoms and one from 30 fathoms.

1. Madrepora crateriformis, n. sp. (Plate XXIII. fig. 1.)

The corallum is in the form of an oval-shaped cup 8 by 10 cm. in diameter, and about 1·5 cm. deep, with one subcentral stem on the underside; its edge is about 3 mm. thick, and formed by a mass of budding corallites. The epitheca is very evenly continued underneath to the edge of the cup and shows a number of concentric lines of growth. The inner part of the cup is crowded with small, very even-sized corallites; these in places may form short lines of rather more prominent corallites, but there is no greater approximation towards the typical axial corallite of the *Madrepora* than there is in many of the *Turbinaria*. The corallites are tubular, 2–3 mm. in length by about 1 mm. in diameter, and somewhat appressed to the walls of the cup; the upper openings of the calices are ·4–·5 mm. in diameter, and there are usually 7 in 1 cm. Generally neither septa nor columella can be distinguished, but there are often some larger spines at the edge of the calice, which indicate their position. The walls of the corallites are covered with relatively long, rough, flattened, blunt spines, which in places give rise to irregular striations. The cœnenchyma is a rather coarse reticulum, covered with similar spines; it is well developed at the edges of the cup, but completely hidden by the tubular corallites within.

Funafuti; lagoon shoal.

There is only one specimen, which may be the young form of some previously described species, but it does not appear like the incrusting base of a colony, nor do its corallites correspond to the descriptions of those of any of the species described in the British Museum Catalogue. The colony, if it is, as I believe, adult, shows an approach to the *Turbinaria*, but, if young, indicates a stage not far from that from which the *Turbinaria* and the *Madrepora* diverged in their development.

2. Madrepora secunda, Dana (2).

The specimen, which is about 13 cm. high, very closely resembles Dana's description. The branches are, however, more crowded and grow almost vertically. The primary septa are distinct, the directives being more prominent.

Funafuti; outer reef.

3. Madrepora rotumana n. sp. (Plate XXIII. fig. 2.)

Corallum massive, of broad plates, formed by the fusion of branches radiating from a short and stout pedicle. Two to four plates thus formed generally arise from the pedicle and radiate

out at right angles to it, being often 20–30 cm. long by about 10 cm. broad at the base and the corallum 3 cm. thick; the end twigs are incompletely fused. On the upper surface are a number of conical elevations, really formed by the end twigs having turned upwards and having budded out fresh twigs at their bases; they vary largely according to position, but are seldom more than 3 cm. high by 1·5–3 cm. broad at the base. The axial corallites are 2·5–3 mm. in diameter, and are seldom more than 1 mm. exsert; the opening of the calice is about 1 mm. broad. The sides of the cones and the upper surface of the corallum are covered by nariform or tubi-nariform corallites about 1·5 mm. in diameter by 2–3 mm. in length; they are generally about 3 mm. apart, and the intervals between are occupied by small immersed or subimmersed corallites. The primary and secondary septa are generally distinct in the axial corallites, the directives nearly meeting in the middle line, the secondary much narrower and thinner; generally in the radial corallites six very narrow thick septa can be distinguished. The under surface of the corallum is covered with round immersed corallites about 1 mm. in diameter and 1–3 mm. apart; the primary septa are distinct, the directives more prominent. The corallum is formed by very coarsely reticular elements, covered on the upper surface by low granular spines, which may form striations; the under surface of the plates seems to be thickened by a true cœnenchymatous formation, showing very clearly in section two elements, the one parallel and the other perpendicular to the under surface.

Rotuma; outer reef.

This is by far the most abundant coral on the reefs of Rotuma, and is found in places covering as much as 25 per cent. of its surface. In general appearance its upper surface resembles *M. smithi*, but the colony is always very distinctly pedicellate.

4. Madrepora robusta Dana (19).

Rotuma; 4 fathoms. A fragment.

5. Madrepora pulchra Brook (22).

Var. *alveolata* Brook.

I have referred, after some hesitation, a specimen to this species and variety. The ends of many of the branches have been killed, apparently by sand, and the remaining branches are stunted and much divided near their apices.

Rotuma; boat channel.

6. Madrepora austera Dana (35).

A much-branched specimen covered with tubi-nariform radial corallites. The surface of the corallum is finely echinulato-striate, and there are a few small obsolescent calicles between the large radial corallites. The primary septa in the radial corallites are deep but distinct.

Rotuma; 3 fathoms.

7. Madrepora aspera Dana (43).

Rotuma; 3 fathoms.

8. Madrepora scabrosa Quelch (45).

A horizontally spreading, much divided branch, 14 cm. long, of this species was obtained. The branch is 1·2 cm. thick at its broken end, and the terminal branchlets, which grow up vertically, are about ·6 cm. thick, 3 cm. below their apices. The corallites correspond very closely to those of the type, but are rather more appressed to the branches, and a few are large and subimmersed. The under surface of the branch is finely echinulate, and towards the base bare of any corallites.

Funafuti; 35 fathoms.

9. Madrepora reticulata Brook (52).

A specimen 15 cm. long was obtained, which closely resembles the type. Some of the tubular corallites of the under surface are 6–9 mm. long and slightly proliferous; they are fused in many places one with another, and by fusion with other branches, towards which they may be growing, give rise to the close reticulations characteristic of the species.

Funafuti; 35 fathoms.

10. Madrepora profunda, n. sp. (Plate XXIII. fig. 3.)

Corallum consisting apparently of a number of stems arising almost horizontally from an incrusting or pedicellate base, covered above with low twigs about 4 cm. long by ·6 mm. in diameter at the base. Branches often somewhat angular, generally about ·9 mm. in diameter, in places forming a very irregular network with slightly elongate meshes. The axial corallites are usually oval in shape, and vary up to 2·5 mm. in long diameter by 1·5 mm., the opening of the calice being about 1 mm. by ·6 mm., they are about 1 mm. exsert. Radial corallites near the ends of the branches nariform and somewhat compressed, the rim of the calice extending at right angles to the stem and its opening being oval or boat-shaped; a few are tubular and slightly proliferous. Toward the bases of the twigs the radial corallites become gradually less prominent, giving place on the main branches to subimmersed and completely immersed corallites. The latter very regularly cover the main branches, and are situate about 3 mm. from one another; they vary from 1–1·3 mm in diameter. In nearly all the calices the primary septa can be recognized as narrow lamellæ, the directives rather more prominent; in the immersed corallites the secondary septa too are quite distinct. The surface of the corallum is dense and very echinulate; the walls of the corallites are strongly striate, and their edges are much spined.

Funafuti; 30 fathoms.

The specimens on which this species is founded consist of a very large number of fragments, all obtained in the same haul of

the dredge and probably from the same colony. The species, though distinctly belonging to the subgenus *Odontocyathus*, differs from all its previously described species in the extremely large immersed corallites found on its main branches and under surface.

11. Madrepora surculosa Dana (97).

There are two specimens of this species in the collection, which are prostrate in form and have the branches on the under surface completely fused along their length except at the extremities. The under surface, close to the pedicle, is bare even of completely immersed corallites.

Funafuti; lagoon shoals.

12. Madrepora latistella Brook (107).

Funafuti.

13. Madrepora sinensis Brook (110).

I have referred a specimen 16 cm. in diameter to this species. The colony is very regularly incrusting, with short branches 4–6 mm. in diameter on the upper surface, often fused with one another. Towards one edge some thicker branches project horizontally; they are very regularly covered with short branches on their upper surfaces, but on the sides have a few tubular corallites and on the under surface immersed calices. The surface of the corallum is very regularly echinulate, in some places striate.

Funafuti; outer reef.

14. Madrepora hebes Dana (128).

Rotuma; 4 fathoms. A fragment.

15. Madrepora monticulosa Brook (130).

A small specimen 17 by 10 cm. was obtained. The corallum is 3·5 cm. thick where it was broken off from a larger mass and about 1 cm. at the edge. The upper surface is covered by low subconical prominences ·5–1·5 cm. high. The edge is slightly lobed and crowded with subequal, low, thick-walled corallites, among which the axial can scarcely be distinguished.

Rotuma; outer reef.

16. Madrepora hispida Brook (132).

The specimen, which consists of one thick, somewhat rounded branch about 26 cm. long, corresponds very closely in all respects with the type. It is 7 cm. thick at the base, and evidently grew in a semi-recumbent position; the under surface, where it is not dead, is smooth and has a few scattered immersed corallites.

Rotuma; outer reef.

17. Madrepora securis Dana (133).

Wakaya, Fiji; outer reef.

18. Madrepora cuneata Dana (134).

There are four specimens of this species, three of which consist of horizontally spreading plates with well-developed epitheca, while the fourth is a much-contorted stem 4·5 cm. high.

Wakaya, Fiji, and Funafuti; outer reefs.

19. Madrepora fruticosa Brook (140).

Funafuti; 6 fathoms. Fragments.

20. Madrepora gemmifera Brook (146).

A branch obtained off the chain of a buoy in Levuka Harbour, Fiji, weighed 20 grams, a growth of not more than 22 months.

Levuka and Wakaya, Fiji; 0–6 fathoms.

21. Madrepora seriata Ehrenberg (156).

Rotuma; 3 fathoms. Fragments.

22. Madrepora bæodactyla Brook (168).

There are two specimens of this species, the one closely resembling the type and the other the variety from Rodriguez, mentioned in the Brit. Mus. Catalogue.

Funafuti; outer reef. Rotuma; 3 fathoms.

23. Madrepora loripes Brook (176).

I have referred a small specimen to this species. Its surface is very distinctly echinulato-striate, and its branches have in one place anastomosed one with the other.

Funafuti; 6 fathoms.

24. Madrepora polymorpha Brook (182).

Rotuma; 3–6 fathoms.

25. Madrepora angulata Quelch (212).

I have referred a branch to this species, which very closely resembles the type. The radial corallites on some of the twigs are situated very regularly in four rows.

Funafuti; 35 fathoms.

II. Genus Turbinaria.

Turbinaria Oken, Lehrb. der Natur., Zool., 1815.

There is a marked absence of this genus both at Funafuti and Rotuma, only one colony having been found, while in Fiji three species were obtained.

1. Turbinaria danae Bernard (3).

There are two fragments of this species, which very closely approach the types. The largest of the two specimens is a pronounced inner fold, having on its edge very prominent corallites, some being 6 mm. long with buds at their sides.

Wakaya, Fiji; lagoon, 1–2 fathoms.

2. Turbinaria schistica, n. sp. (Plate XXIV. fig. 9.)

Corallum very closely approaching that of *T. orbicularis*, but altogether much thicker and more massive. Edge of the corallum generally about 3 mm. thick, not wrinkled on the under surface. Calices usually 2–3 mm. in diameter, with margins slightly protuberant as thin rings about 1 mm. high. There are in most calices 24 thin septa with rather rough edges, projecting but little into the calice; their upper edges project at a very acute angle to the edge of the calices and their inner edges are almost vertical. The columella is very conspicuous, round and rather protuberant, situated about 1·5 mm. below the upper opening of the calice and formed by a rather coarse flaky reticulum. The cœnenchyma is composed of a fine reticulum, moderately spiny on the surface, and formed of somewhat thin and flattened elements, which give it a distinctly flaky appearance.

Wakaya, Fiji; lagoon, 1–2 fathoms.

There are two fragments of this species, the edges of a cup. The greater part of the under surface of the corallum of both has been killed, giving somewhat the appearance of an epitheca, but the sections show very clearly the extent to which it has gone on; the corallum of one piece, 3·5 cm. from the edge of the cup, is 2 cm. in thickness, but of this the lower half is quite dead.

The species very closely approaches to *T. orbicularis*, but it is at once separable by the characters of the cœnenchyma.

3. Turbinaria pulcherrima Bernard (30).

One small specimen, weighing 45 grams, a growth of less than 22 months, was obtained off the chain of a buoy. Owing probably to its position, its growth is rather more irregular than the type.

Levuka, Fiji; harbour, 2 fathoms.

4. Turbinaria mesenterina Bernard (37).

I have referred six pieces from the same colony to this species, with which they closely correspond in their cœnenchyma and in the parts within the calices.

Rotuma; pool in outer reef.

From my specimen, it seems as if this species should rather be placed among the *foliate types*. The type specimen in the British Museum grew probably in a hole near the extreme outer edge of the reef, where its upper edges would be just awash at low tides, and consequently would be unable to grow further upwards; everywhere between its folia also are the tubes of worms and molluscs.

III. Genus Astræopora.

Astræopora Blainville, Dict. des Sci. Nat. t. ix. p. 348 (1830).

There are eight specimens of this genus, which I have referred to four species. The genus, although represented by so few species, is a fairly abundant one in the lagoon of Funafuti and the boat-

channel of Rotuma. Great spreading masses are formed which die in the centre and become somewhat hollowed out, but continue to grow at the sides. The mode in which the colony grows, whether explanate, pulvinate, or globular, is, I think, due to local conditions as to depth below low tide and current, and also to the character of the rock on which the embryo first fixed itself. In my collection there are three specimens of *A. listeri*, one of which is typically pulvinate, one shows approximation to the globular type, while the third, a young colony about 6 cm. in diameter, is distinctly globular. The great variety shown between the upper and the under sides of the species I have named *A. tabulata* seems to show that there is little value in the naming of species of this genus from the skeleton alone.

1. Astræopora listeri Bernard (6).

This species seems to be an extremely variable one, but the three specimens in the collection closely correspond to types in the British Museum.

Funafuti; lagoon.

2. Astræopora tabulata, n. sp. (Plate XXIII. fig. 4.)

Corallum showing the pulvinate type of growth. Corallites slightly protuberant, hemispherical, generally about 3 mm. high, often coalescing at the sides, but the valleys between usually distinct, with here and there young corallites. The calices are from 1·8–2·2 mm. in diameter and from 3–4 mm. apart; the primary and secondary septa are of nearly equal size, scarcely visible above, but below can be traced as 12 very thin laminate narrow plates with smooth edges, not meeting at the centre. A few of the tertiary septa are sometimes visible. About 7 mm. below the opening of the calice somewhat thick tabulæ, often arched in the centre, occur; of these there are about 11 in 1 cm., but the septa are very distinctly continuous through them and the cell is not filled up at all with stereoplasm. The cœnenchyma is extremely echinulate, ending on the surface with somewhat flattened low spinulous projections, which on the sides of the corallites tend to form very regular striations. In sections the interlacing of the costal elements from neighbouring cells is very distinctly visible. The colour of the living colony is green.

Funafuti; lagoon. Rotuma; boat-channel.

I have referred to the same species another specimen from Funafuti, which is apparently the under part of a colony, the top of which has broken off and rolled over; the greater part of it has been killed by incrusting nullipores and the corallites on its surface do not generally project. The calices vary greatly in size, and generally have the primary septa distinct and projecting nearly to the centre of the cell; the secondary septa are small. The cœnenchyma is very echinulate, and the section shows the same arrangement of the tabulæ and of the costal elements as in the types above.

3. Astræopora punctifera Bernard (11).

I have referred a specimen to this species, but I am doubtful whether the species is really distinct from *A. listeri*.

Rotuma; boat-channel.

4. Astræopora ovalis Bernard (12).

There is one specimen of this species, which is considerably larger than the type but exhibits quite as regular a mode of growth and differs in no respect.

Funafuti; lagoon.

IV. Genus Montipora.

Montipora Quoy & Gaimard, Voy. 'Astrolabe,' Zooph. p. 247 (1833).

Montipora Bernard, Brit. Mus. Cat. Madreporaria, vol. iii. (1897), p. 13.

Of the nine species represented, all with one exception were obtained from the comparatively still water of the lagoon or boat-channel.

The living tissues form a layer a few mm. thick on the surface of the colonies; underneath this the corallum is generally much corroded, and bored by Chætopoda, Gephyrea, and Mollusca, especially *Lithodomus*. The massive forms, after attaining a certain thickness, are often killed at the base by sand, &c.; the dead part begins to be corroded, but a fresh growing edge forms, and a constant struggle seems to be going on between the edges and the sand beneath. Often the stem becomes completely worn through, so that the mass falls over, and is at once killed by the sand, in its turn perhaps forming a fresh foundation for the larvæ of the same or some other genus of coral. It is interesting to note that I never found any colony with the upper part hollowed out or dead, or in any way exposed at even the lowest tides.

I am indebted to H. M. Bernard, Esq., M.A., of the British Museum, for naming the species. Of these, four are new and three have been already described in an appendix to the British Museum Catalogue of the genus. Mr. Bernard has also very kindly described the new species, *M. columnaris*, here given.

A. *Foveolate*.

1. Montipora columnaris Bernard, n. sp. (Plate XXIII. fig. 5.)

Corallum grows in erect, irregular spikelets, thickened by repeated incrustations. Tips poiuted or flattened. Each new growth forms a living cap on the stock, 6–7 cm. in length.

The calicles are numerous, almost uniformly scattered, about 1 mm. apart and ·6 mm. in diameter, with many smaller appearing on the thick interstitial ridges; conspicuous, deep, with open fossa and feeble septal apparatus (from 6–12); with solid columella-like body, deep down in the fossa.

The cœnenchyma consists of a dense reticulum, which early solidifies, tending thereby to diminish the apertures of the calicles and to further obliterate the septa. In the section of the column the thin axial strand is hardly distinguishable from the cortical layer; both are very dense. At the tip of the growing stock the reticulum may be lighter and run in parallel striæ up the growing point. The interstitial ramparts, which are more or less obliterated towards the bases of the stock, are round and thick, but near the growing point may be sharper and thinner.

Rotuma; boat-channel. Wakaya, Fiji; lagoon.

Under this heading two specimens, which appear to be related, are grouped in spite of some important differences. Superficially they resemble detached spikes of *M. irregularis* from Zamboanga. They differ, however, in the apparent absence of any expanding and incrusting base, in the smaller size of the calicles, in the characters of the septa (which are very well developed in *M. irregularis*), and in the density of the cross section. In *M. irregularis* the spikes appear to grow rapidly and to be throughout of a light spongy reticulum. In the coral under discussion the growth is apparently slow and the corallum early solidifies.

The two specimens differ in that the one from Rotuma has a sharp pointed tip (with a few broken off spikes), the septa very fully developed and the cœnenchymatous reticulum dense, even right up to the growing tip; while in the specimen from Fiji the tip is a sharp flattened edge, the septa are rather better developed, and the reticulum near the growing tip is lighter, more delicate, striated as mentioned above, and the whole is more foveolate.

The two specimens are classed together because the manner of growth appears to be the same, both have nearly solid section, and the lower, more adult portions of the stocks are very similar. Owing to the flattening of the interstitial ramparts near the bases of the stocks, the specimens might perhaps be classed under the heading glabro-foveolate.

2. Montipora foveolata Dana (39).

One specimen from Rotuma shows typical foveolation on one side, but on the other the ramparts are broken up into curved plates (*cf.* specimen *e* Brit. Mus. Coll.), which tend to rise above the level of the surface (*Bernard*).

Rotuma; boat-channel. Wakaya, Fiji; lagoon.

3. Montipora socialis Bernard (40).

The specimen of this species differs from the type specimens in the Brit. Mus. (which are fragments from the edge of a larger stock) chiefly in being massive and of a closer consistency. The ridges thinner, sharper, and taller (*Bernard*). The calices are larger than in the type, being from 1–1·5 mm. in diameter; primary septa also distinctly larger than secondaries.

Rotuma; boat-channel.

4. Montipora profunda Bernard (137).

Funafuti; lagoon.

5. Montipora caliculata Dana (41).

Var. *piriformis* Bernard (pp. 59 & 178).

Funafuti; lagoon.

6. Montipora saxea Bernard (139).

Besides the two specimens in the British Museum, there is a third specimen at Cambridge, which appears to be the free end of a massive block.

Its edges are perfect, about 3 mm. thick, either creeping over a much-corroded substratum of the same species of coral, or free for 2–3 mm., and closely followed by a well-developed epitheca.

Funafuti; lagoon.

7. Montipora verrucosa Lamarck (80).

On one specimen a colony of *Pocillopora suffruticosa* has settled.

Funafuti; lagoon.

8. Montipora incognita Bernard (109 & p. 181).

This species grows in large, generally horizontally spreading masses, sometimes a metre or more in diameter, with a broad attachment in the centre. The edges are often free for 30 cm. or more, but occasionally supplementary attachments are formed to the rock beneath. The upper surface, especially over the central point of attachment, is studded with nodules, 3–6 cm. high, often dead at their summits.

Funafuti; 0–7 fathoms, extremely common both in the fissures of the outer reef and on the shoals within the lagoon.

9. Montipora granifera Bernard (141).

Funafuti; lagoon.

V. Genus Porites.

Porites (pars), Lamarck, Hist. Anim. sans Vert. ii. p. 267 (1816).
Porites, Duncan, Rev. Madrep. p. 187.

There are 45 specimens of this genus in the collection, some fragmentary. I have been able to refer 38 of these to 9 species, the variations in which I have carefully recorded. Of these 6 species seem to me to be new, and I have redescribed one old species (*P. arenosa*) and added two varieties to it. I have had the advantage of comparing my specimens with the 'Challenger' types in the British Museum; these seem to have been described rather hastily, and at least two from worn specimens, the characters of the calices of which are rather obliterated.

The youngest colony in the collection, which I have not referred to any species, has 9 calices in 3 rows. The massive colonies

seem to me to be formed from such by the edges creeping out by budding-off calices regularly in lines. Then thickening takes place by the direct upward growth of the cells and budding in the cell-walls, where three or more calices meet.

It is interesting to note that no branching-forms were obtained at Funafuti or Rotuma, and that no colonies were found on the outer reefs proper of these islands.

1. Porites alveolata Edwards & Haime. (Plate XXIV. fig. 1 *a*.)

Porites alveolata Edwards & Haime, Cor. iii. p. 178.

I have referred a small, closely incrusting colony to this species. Its calices are small, 8–9 in 1 cm., generally considerably deeper than broad, with relatively thick walls covered with rough, somewhat granular spines. The septa are 12 in number, thin, and little projecting, with almost perpendicular edges. In front of and joined below to the primaries are 4–6 thick, rough, but little projecting pali. Deeper in the calices both these and the septa seem to be united by a ring of corallum, leaving in the centre, as there is no columella, an extremely deep axial fossa.

Rotuma; boat-channel.

2. Porites viridis, n. sp. (Plate XXIV. figs. 1 *b*, 2.)

Corallum massive, uneven, irregularly monticulose, incrusting at the base; growing edges thin, generally not more than 2–3 mm. in thickness, closely covered by the epitheca, and often free for 5–10 mm.

Calices deep (1 mm.), polygonal, generally very regular in size, 1·5–2 mm. in diameter, or about 6 in 1 cm.; in the deeper valleys smaller and irregular, often elongate. Cell-walls very thin on the surface, but much thicker below, being at the base of the calice about a third its diameter in breadth; where 3–4 calices meet they are often much thicker, and fresh calices are budded-off. Upper edges of the walls covered with low, blunt, rough spines, and just within the calice, apparently attached to its wall, there are 12 thick, rough, projecting spines, corresponding to the septa which arise deeper. Secondary and primary septa often fused at their edges, and fused to the latter are 4–6 generally thin, blunt, rough, and little projecting pali. Lower in the calice a ring of corallum is often seen, joining all the edges of the septa together; from this strands of corallum run to join in the centre of the axial fossa, giving rise apparently to the small blunt columella, which is almost as prominent as the pali.

In section the corallum is seen to be dense and heavy, the walls of the cells thick and compact, with a very regular, close, palisade arrangement across the cells below the base of the columella.

Var. apalata. (Plate XXIV. fig. 1 *c*.)

The calices are generally less deep than in the type, and have rather thicker walls. The septa are 12 in number, generally less

regular and thinner than in the type, with their edges seldom fused one to another; in some of the cells 2–4 low pali can be distinguished, appearing like mere thickenings at the edge of the septa, but usually they are completely absent or quite indistinguishable. Columella generally absent or indistinct; in some of the calices strands of corallum occupying the bottom of the axial fossa, which in others is very deep.

The type specimens (4) of this species were all obtained from a pool in the reef near the island of Solkopi, to the east of Rotuma. The variety was found on the reef quite near, and probably the variations in its calices are correlated with its position. The types of the species are two massive pieces broken off from the edges of colonies and two quite young colonies. The latter have the corallum less dense, walls thinner, septa seldom fused, pali often more marked and regular, and columella sometimes quite small or even indistinguishable.

The specimen of the variety is rather more uneven and mamillate on the upper surface than the type. To it I have also referred a small incrusting specimen, which differs in having the septa more marked, regular, and broader, with both pali and columella indistinct.

The calices in all the specimens are in places arranged in lines, the walls between neighbouring calices in the line being thinner than between the calices of the one line and the next; such lines are rather irregular, but usually seem to run parallel to the growing edge. The colour of the living colonies, both type and variety, was the same, a very bright dark green.

3. Porites purpurea, n. sp. (Plate XXIV. figs. 1 *d*, 3.)

Corallum massive, uneven, irregularly monticulose, and mamillate, or with short columniform outgrowths, incrusting at the base; growing-edges 1–2 mm. thick, closely covered by the epitheca, and often free for a few millimetres.

Calices usually quite shallow, polygonal, about 2 mm. in diameter on the tops of the mamillations and on the columniform outgrowths, but much smaller in the valleys between and irregular in outline. Cell-walls sometimes quite thin on the surface and angular in section, but more often, especially near the base of the colony, quite blunt and as much as ·5 mm. thick. Upper edge of the wall covered with rough blunt spines, on the thin walls a single row flattened at right angles to the wall between neighbouring calices and appearing continuous with the septa within each; the thick walls present an appearance as of three rows of spines, a central higher one, and a row on each side, but the latter is really a large tooth on the upper end of the septa, projecting in the thin-walled calices almost at right angles to the walls, but in the thick-walled almost vertically outward. Septa 12, secondaries often fused with the primaries, usually thin with rather rough sides, projecting for about a third its breadth into

the cell. Pali usually 5–7, opposite and fused to the edges of the septa, sometimes quite thin and styliform, but generally thick with rugged sides; their summits usually level with that of the wall between the calices. Deeper in the cell septa and pali joined by a ring of corallum, from which arise 3 or 4 strands to meet in the centre of the calice, where the columella projects as a distinct thin style with its summit in the thick-walled calices little below those of the pali.

In section the corallum is seen to be composed of very coarse elements disposed in a very regular cross palisade arrangement.

Funafuti; lagoon shoals.

There are three specimens of this species—one a mamillated mass about 6 cm. high by 7 cm. broad, the second a column-like outgrowth, covered on the sides with mamillations, 11 cm. high by 6 cm. in diameter at the base, while the third is a mass intermediate in form between these two. The colour of the living colony with the polyps expanded is a dark purple, that of the cleaned corallum light brown.

The species is very abundant at Funafuti, and resembles in some respects *P. columnaris* Klunzinger, but I nowhere saw anything approaching the long columniform outgrowths which are described for that species.

4. Porites trimurata, n. sp. (Plate XXIV. figs. 1 *e*, 4.)

Corallum massive, uneven, slightly monticulose, incrusting at the base, but in the larger colonies with no free growing-edge; commonly flat table-topped, with a broad central pedicle and edges about 7 mm. thick, covered with living calices which extend for about 2 cm. on the lower side.

Calices polygonal, moderately deep, about 1·5 mm. in diameter, or 6 in 1 cm., smaller in the depressions. Cell-walls very thin, regular, dense, and with few perforations, covered on the upper surface with thick, rough, slightly flattened spines, which correspond in position to the septa in the calices on each side. Septa 12, appearing on the walls ·4–·5 mm. below their upper edges and projecting into the calices for about a quarter their breadth, usually rather thick with bluntly spinulous summits and rough sides; inner edges seldom fused with one another, thickened, rough, very slightly projecting, apparently due to the fusion with the pali, which would then vary in number from 6 to 12. Inside the calice, between the thin wall proper and the point where the septa may be seen distinctly arising, the wall is covered with low, broad, rough spines, which in some parts form a distinct ring within the calice, arising inside the true cell-wall from apparently another wall, which is closely connected to it by the elements of the corallum. On the undersides of the table-formed colonies the calices present the same characters, but the pali are more distinct and only lie opposite the primary septa, with which they are fused below. The septal edges and pali are joined below by a ring of corallum, from which usually 6 elements arise, fusing in the centre

of the calice, where a low, thin, often much-flattened columella arises.

In section the layer with living tissues is seen to be about 3 mm. thick. The corallum is formed of fine elements, with a very close-latticed arrangement, giving it an appearance of great density. Where the living tissues do not cover the corallum, it is much pitted and corroded.

Funafuti; lagoon shoals. Wakaya, Fiji; lagoon.

There are in the collection portions of three colonies and one young colony. The latter is closely incrusting at the base and differs from the older colonies in having the inner wall of the calices less distinct, in most parts seemingly fused with the true wall. If the wall between the calices in the *Porites* is, as I believe, the true theca, then these inner walls must be regarded as supplementary thecæ. From the comparison of the exposed sections of this species with those of *P. purpurea* and *P. viridis*, I am inclined to believe that the cell-walls of these and other relatively thick-walled species are formed of three elements—first the fused thecæ which primarily would be double, and then two supplementary thecæ.

The pali vary extremely, but, from the comparison of the calices in the different specimens, I think that all the septa have primitively a prominent paliform tooth. In front of the primary septa then appear the pali, thin, styliform, equally prominent projections, which fuse almost at once with the edges of the septa, giving rise to a crown of large and small prominences around the large central fossa, in the middle of which the columella arises. Secondarily, owing to physical causes, these may, I think, be enlarged on the secondary septa, giving the appearance of a larger number of pali.

From the examination of a large number of specimens, it seems to me that primitively there are 6 pali in all the massive species, and that all modifications are really due to causes such as I have sketched above.

5. Porites umbellifera, n. sp. (Plate XXIV. figs. 1*f*, 5.)

Corallum massive, uneven, slightly monticulose above, often table-topped with a broad central attachment.

Calices polygonal, shallow, and almost superficial in places, about 1·3 mm. in diameter, or 7 in 1 cm. Cell-walls thin, with few perforations, with rough uneven summits without any definite spines, but higher opposite to the septa. Within the wall arises a circle of 12 thick, large, rough, thorny spines, with their summits level with the top of the wall, lying on the top of a definite supplementary wall (or theca), which is relatively more internal than in *P. trimurata*, but less perfect, consisting in many places of thickenings on the sides of the septa which have not yet fused. The septa (12) then get very thin and almost smooth-walled, running into the calice for about a third of its breadth, where the secondaries and primaries are generally fused together and with the pali, giving 6 large, rough, prominent styles with their summits

little below that of the wall. In the centre of the cell the columella is similar in appearance to the pali, and almost as prominent, springing from the fusion of a number of strands of corallum arising from a regular, deep ring joining the edges of the septa and pali.

In section the corallum is seen to be formed of rather coarser and more open elements than in *P. trimurata*, with the usual palisade arrangement. It is also distinctly less heavy.

Funafuti; lagoon shoals.

There are two specimens, a chip from the summit of a massive block and a part of the edge of a table-topped colony. The former shows very well the triple nature of the wall, but has the pali and columella less distinct.

The species is closely allied to *P. trimurata*, but is at once distinguished by its smaller calices, more open corallum, and regular pali.

6. Porites parvistellata Quelch. (Plate XXIV. fig. 1 *g*.)

Porites parvistellata Quelch, Challenger Report on Reef-Corals, p. 184, pl. xi. figs. 8–8 *a*.

I have obtained two specimens of this species, which very closely correspond to the type in the British Museum. The calices generally are about 1 mm. broad, and the same in depth, but near the edges of the colony tend to become somewhat larger, thinner-walled, and almost superficial.

Rotuma; boat channel.

7. Porites arenosa Esper. (Plate XXIV. figs. 1 *h*, 6.)

Madrepora arenosa Esper, Pflanz. t. i., Suppl. p. 80, Madr., tab. lxv. (1797).

Porites arenacea Lamarck, Hist. des Anim. sans Vert. t. ii. p. 270 (1816).

Porites arenosa Milne-Edwards & Haime, Cor. iii. p. 180.

In the collection there are 13 specimens, which closely resemble the published descriptions of this species, but all of which bear considerable resemblances to *P. lutea* also. In addition I have examined a large number of named (?) and other specimens in the British Museum without being able to find any point which I should consider of specific difference between them. I leave, therefore, the additional characters of the two so-called species, given by Klunzinger, Quelch, and others, with the remark that a series shows very great variability in the arrangement of all the parts within the calices, and secondly that no character taken from the form of the colonies of the two species can be of any specific importance. The description would then be as follows:—

Corallum primarily incrusting at the base, with a great tendency to thicken, so as to form moderately thick flat masses with generally level summits, but occasionally a few low, rounded elevations. The top, on the colony reaching a certain size, invariably dies in

the centre (or is killed by the accumulation of sediment), but the polyps remain alive at the edges, which are usually not more than 12 cm. broad, so that flattened, hollowed-out masses often 2 metres or more in diameter result. The edges locally, however, are often killed, so that the living corallum forms no continuous line but a series of blocks, varying greatly in size, round the whole mass, often attached by their whole bases, but often by quite narrow stalks, so that they are frequently broken off (owing to the weakening caused by the boring into them of worms and other animals). The growing edge of the corallum where it is visible is extremely thin (1 mm.), very closely incrusting, the epitheca extending nearly to the edge.

Calices polygonal, shallow, 1·4 mm. in diameter, or 7 in 1 cm., smaller in the valleys. Cell-walls distinct, thin and linear on the surface, not thickened below; upper edges smooth, undulating, or covered with low, rough spines, corresponding in position to the septa in the neighbouring calices. Septa 12, rather thin, almost equal-sized, projecting into the calice for about a third of its breadth; edges of secondaries and primaries sometimes fused, with generally three rough spiny prominences on the upper edges, the first close to the wall of the cell, the second slightly deeper, about halfway along, and the third at its free edge; the latter spine sometimes fused with the middle one, larger on the primaries than on the secondaries, where it is generally scarcely distinguishable and rather deep in the cell. Pali 6, fused with the edges of the primary septa, but little projecting above its edge; their summits about ·4 mm. below that of the cell-wall. Septal edges (and pali) often joined together, but no distinct ring of corallum. Columella very variable, often scarcely noticeable, but usually a distinct, thin, flattened plate with its summit little below those of the pali, arising from the junction of several strands of corallum from the septal edges in the centre of the calice.

In section the corallum appears somewhat open, the longitudinal elements rather coarse, while the transverse are very delicate and thin.

Funafuti; lagoon shoals and 7 fathoms.

Var. LUTEA. (Plate XXIV. fig. 1 *k*.)

Porites conglomerata, var. *lutea* Quoy & Gaimard, Voy. de l'Astrob., Zooph. p. 249 (1833).

Porites lutea Edwards & Haime, Cor. iii. p. 180.

Porites lutea Klunzinger, Die Korallthiere des roth. Meeres, t. ii. p. 40.

In this variety the wall of the calices is usually rather rougher than in the type. The septa are slightly thicker, the two outer sets of spines generally smaller, the edge of the primaries fused with the pali, giving 4–6 large, thick, rough and prominent points round the centre of the calice, in which a small low columella can with difficulty be distinguished.

Funafuti; lagoon shoals. Wakaya, Fiji.

Var. PARVICELLATA. (Plate XXIV. fig. 1 *l*.)

In this variety the calices are much smaller than in the type, being seldom more than 1 mm. in diameter. The calices are similar in appearance, but the septa are rather rougher, and the pali more distinct from the septa and more prominent than in either the type or the preceding variety. The columella, too, is thicker and more prominent.

Funafuti; lagoon shoals.

The species above described is subject to much variation in the parts within its calices; and in different parts of the corallum nearly all the stages between the type and these two varieties can be found. For instance, the septa in some cells of the same colony are quite thick with no distinguishable pali, while in others the septa are thin and the pali well marked, perhaps completely separate from the septa. In a curve of variation of these characters there would seem to be two prominent points which I have recognized in my descriptions of *P. arenosa* and its var. *lutea*. It seems to me, too, that *P. conglomerata* (Esper), *P. parvistellata* (Quelch), and probably several of the West-Indian species, will have to be placed under this head, when a long series is examined.

The var. *parvicellata* differs mainly in the size of its calices, but their great regularity precludes the idea of this being due to local conditions.

The living colonies, which are of a golden-green colour, are common on all the shoals of the lagoon of Funafuti, but are not in any way uncovered, even at the lowest tides.

8. PORITES SUPERFUSA, n. sp. (Plate XXIV. figs. 1 *m* & 7.)

Corallum rough, closely incrusting, retaining the shape of the surface over which it is growing; the edges thin, 1–1·5 mm., closely followed underneath by the epitheca, often free for a few mm. where the incrusted surface is uneven, and so easily bridging over any small cavities in it.

Calices usually round, ·5–·9 mm. in diameter, in the depressions polygonal and still smaller. Cell-walls very thick, obtuse and solid, often as broad as the calices, but in the valleys quite thin and angular. Upper edge of the wall covered with low, rough, blunt spines, giving them a very granular appearance. Septa somewhat irregular, usually 12, generally rather thick with rough sides, arising deep down in the calices and projecting for about a third their diameter, primaries and secondaries sometimes fused at the edges. Pali fused below to the septal edges, thick, rough, blunt and extremely prominent, their summits almost level with the top of the walls. There is visible no complete ring of corallum joining the septal edges and pali, but usually 3–4 strands from the pali run across the calicular fossa, meeting in the centre, where a small, prominent, styliform columella is situated.

In section the elements of the corallum present an open palisade arrangement and are noticeably thin and delicate.

Funafuti; passage in reef, 5 fathoms.

The specimen is an incrusting growth 12 by 7 cm., in no part seeming to be as much as 1 cm. thick. In places the edges have been killed, and two pieces have thus been cut off, but were evidently still alive when first obtained. The colour of the living colony was green. The walls of the cells are studded, where three or more meet, with the open ends of the calcareous tubes of some worm; these are about ·4 mm. in diameter, and around many the corallum has taken on an appearance as if they were lying in the middle of a calice.

9. Porites exilis, n. sp. (Plate XXIV. figs. 1 *n* & 8.)

Corallum thin, incrusting, sometimes almost massive in the centre, with a few mamillations; growing edge about 1·5 mm. thick, often free for 2–3 cm., closely followed by the epitheca, which usually exhibits regular concentric markings.

Calices shallow, about 1 mm. in diameter or 9 in 1 cm., polygonal or more or less round, in some parts arranged almost in lines. Cell-walls thin but, owing to the upper edges being covered with spines, flattened at right angles to the walls, appearing on the surface rather thick; these spines are very rugged and correspond more or less to the septa. Septa 12, thick with rough sides, projecting into the calice for about a quarter its diameter; the upper edge, where it is attached to the cell-wall, carrying a large, thick, rough spine, projecting considerably into the cell and somewhat upwards, below these running into the calice at right angles to the cell-wall. Inner edges of primaries and secondaries often fused, and below connected together by a ring of corallum, sometimes incomplete in one part. Pali generally 6, fused to the septa, rough but somewhat pointed, with their summits little below the level of the top of the wall. From the ring of corallum extend inwards a number of elements which fuse in the centre of the calice, where the columella arises, styliform but very rough, with its summit almost level with those of the pali.

In section the corallum is seen to be formed of rather coarse elements, having the regular cross-palisade arrangement and rather open meshes.

Funafuti; 7 fathoms. Rotuma; 3 fathoms.

There are three specimens from Funafuti, apparently from two closely incrusting colonies, exhibiting typically the above arrangement within the calices. The specimen from Rotuma has a few low mamillations on the incrusting base; while the calices over the incrusting part are quite typical, those on these elevations have their septa much thinner, arising higher up on the walls and projecting straight into the calices so as to often almost completely obliterate both the large spine at their upper ends and the pali fused to their free edges, the ring of corallum, joining which, is usually higher up in the cell and more distinct. The colour of

the living colony is a brownish black, that of the cleaned corallum brown.

The species is nearly related to *P. lichen* (Dana) and *P. echinulata* (Klunzinger), but the arrangement of its septa and columella is quite distinct.

In addition to those mentioned above I have fragments, which I believe to be referable to *P. gaimardi* (Wakaya, Fiji), *P. tenuis* (Rotuma), *P. favosa* (Wakaya, Fiji), and *P. cribripora* (Rotuma), although all of them exhibit considerable variations; three others, all from Funafuti, seem referable to new species. Of the latter I find no authentically named specimens in the British Museum, but it does not seem to me advisable to make types of mere fragmentary specimens, on which the variations cannot be properly studied.

EXPLANATION OF THE PLATES.

PLATE XXIII.

Fig. 1. *Madrepora crateriformis*, n. sp., ×½, p. 258.
2. *Madrepora rotumana*, n. sp., ×½, p. 258.
3. *Madrepora profunda*, n. sp., ×½, p. 260. 3 *a*. End twig of same, ×1.
4. *Astræopora tabulata*, n. sp., ×½, p. 264. 4 *a*. Single calice.
5. *Montipora columnaris*, n. sp., ×½, p. 265.

PLATE XXIV.

Fig. 1. Sections through the calices of the species of *Porites* along the primary septa and through the columella:—(a) *P. alveolata*; (b) *P. viridis*; (c) *P. viridis*, var. *apalata*; (d) *P. purpurea*; (e) *P. trimurata*; (f) *P. umbellifera*; (g) *P. parvistellata*; (h) *P. arenosa*; (k) *P. arenosa*, var. *lutea*; (l) *P. arenosa*, var. *parvicellata*; (m) *P. superfusa*; (n) *P. exilis*. ×16.
2. *Porites viridis*. n. sp., single calice, p. 268.
3. *Porites purpurea*, n. sp., single calice, p. 269.
4. *Porites trimurata*, n. sp., single calice, p. 270.
5. *Porites umbellifera*, n. sp., single calice. p. 271.
6. *Porites arenosa*, n. sp., single calice, p. 272.
7. *Porites superfusa*, n. sp., single calice. p. 274.
8. *Porites exilis*, n. sp., single calice, p. 275.
9. *Turbinaria schistica*, n. sp., single calice, p. 263.

3. On the Geographical Races of the Banting.

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(Plate XXV.)

Among the larger Mammals of Asia, the Banting is one of those in regard to which our information is most deficient—the British Museum, in addition to skulls, possessing but three specimens, while only a single living example has been exhibited in the Society's Menagerie.